

# Combined surgical and Gamma Knife treatment of extremely rare hypopharyngeal squamous cell carcinoma brain metastasis in the eloquent region

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ABSTRACT – *Objectives*: To present a successful treatment of brain metastasis of hypopharyngeal squamous cell carcinoma by combined surgical and Gamma Knife treatment. *Case description*: We report a 65-year-old male presenting in the emergency room with moderate left hemiparesis and a mild frontal headache. In the past year, he was diagnosed with hypopharyngeal cancer stage IVA (T4a, N0, M0) and has been treated surgically and with adjuvant radiation therapy. He was in complete remission. Contrast-enhanced magnetic resonance imaging showed a right-sided cystic lesion 5.4 x 5.2 cm in size in the basal ganglia, with peripheral contrast enhancement. Diffusion restriction and high relative cerebral blood volume (rCBV) values were recorded. An extensive zone of perifocal edema was affecting the white matter of the frontal lobe on the right. A midline shift of 10 mm to the left was noted and the right lateral ventricle was compressed. *Results*: Surgery was performed. The pathohistological finding indicated the metastasis of squamous cell carcinoma. Tissue was made up of solid clusters of atypical, moderately to well-differentiated squamous epithelial cells focally forming horny beads. The residual part of the metastasis was treated by Gamma Knife Radiosurgery, two weeks after surgery. Three-month follow-up confirmed the absence of neurological deficits and no progression of the intracranial process. *Conclusion*: Patients with hypopharyngeal squamous cell carcinoma and brain metastasis can attain complete intracranial remission after surgical treatment followed by Gamma Knife Radiosurgery.

Keywords: brain metastasis, Gamma Knife Radiosurgery, pharyngeal cancer

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## INTRODUCTION

Brain metastases are the most common intracranial malignancies in adults. Even though pharyngeal cancer has significant metastatic potential spreading not only to regional (lateral neck and retrolatero-pharyngeal) lymph nodes but also to distant sites, cases of hypopharyngeal cancer brain metastases are extremely rare. We report a patient with a hypopharyngeal tumor that was treated by resection followed by radiosurgery with a good result of disease control.

## CASE REPORT

The patient is a 65-year-old male presenting in the emergency room with moderate left-sided hemiparesis. He reported having a mild frontal headache for a few days and noticed weakness in the left side of his body for the past two weeks. No other neurological abnormalities were noted. A year ago he was diagnosed with hypopharyngeal cancer stage IVA (T4a, N0, M0). Laryngectomy and partial hypopharyngectomy with modified radical neck dissection type I were performed and the pharynx was reconstructed using the pectoralis major myocutaneous flap. After tracheostomy, a tracheoesophageal voice prosthesis was placed. Following a surgical procedure, the patient underwent 32 cycles of adjuvant radiation therapy with a total dose of 64 Gy. In the past year, regular check-ups by the oncologist confirmed the remission of the cancer with no signs of local recurrence or dissemination of the disease.

Neuroimaging was performed (shown in Fig. 1.a and 1.b). Contrast-enhanced magnetic resonance imaging (MRI) showed a right-sided cystic lesion 5.4 x 5.2 cm in size in the basal ganglia, with peripheral contrast enhancement. Diffusion restriction and high relative cerebral blood volume (rCBV) values were recorded on the perfusion scans. An extensive zone of perifocal edema was affecting the white matter of the frontal lobe on the right. Midline shift of 10 mm to the left was noted and the right lateral ventricle was compressed with no signs of hypertensive hydrocephalus. Neuroimaging scans indicated the presence of brain metastasis or high-grade glial tumor, primarily a glioblastoma.

The patient was treated surgically. A frontotemporoparietal right-sided osteoplastic craniotomy was performed. The cystic tumor process was verified, the contents were evacuated and sent for microbio-



Fig. 1.a Preoperative axial contrast-enhanced T1-weighted MR image showing a right-sided cystic lesion in the basal ganglia, with peripheral contrast enhancement.

Fig. 1.b Preoperative coronal T2-weighted MR image showing a right-sided cystic lesion in the basal ganglia with large perifocal edema in the frontal white matter.



Fig. 2. Squamous cell carcinoma made up of solid clusters of atypical, moderately to well-differentiated squamous epithelial cells focally forming horny beads (HE 100x).

logical analysis. The rest of the tumor mass was reduced to the greatest extent possible. During the resection of the posteromedial infiltrative part, the neuromonitoring showed a decline in motor evoked potential (MEP) and somatosensory evoked potential (SSEP), so we left a small tumor remnant for Gamma Knife treatment because we wanted to preserve maximum quality of life of the patient after surgery. Tissue samples were taken for pathohistological analysis. Postoperatively, he was hemodynamically stable, afebrile, without signs of infectious disease. Postoperative MEP and SSEP were completely normal. His motor deficits were recovering. Vancomycin-resistant Enterococcus faecium was identified in the cyst content and patient was given linezolid. Pathohistological analysis showed tumor tissue made up of solid clusters of atypical, moderately to well-differentiated squamous epithelial cells focally forming horny beads, and was partly necrotic (shown in Fig. 2.). With finding corresponding to the metastasis of squamous cell carcinoma, the definite diagnosis was established. The residual part of the metastasis as



Figure 3.a-3.d. *Gamma Knife Radiosurgery planning* snapshots: a prescription dose of 19 Gy to prescription isodose 59% was administered to the residual tumor, two weeks after surgery.

well as the resection cavity were verified by MRI and treated by Gamma Knife Radiosurgery. Considering the volume of the postoperative tumor site of 13,193 cm<sup>3</sup>, we decided to give a dose of 19 Gy to prescription isodose 59% to the residual tumor, two weeks after surgery (shown in Fig. 3.). There were no complications during nor after the procedure. Significant regression of the treated tumor site was seen on later brain MRI. Three and sevenmonth follow-ups confirmed the absence of neurological deficits and no progression of the intracranial process (shown in Fig. 4.).



Fig. 4. Three months (4.a) and seven months (4.c) after surgery and Gamma Knife Radiosurgery - axial contrast-enhanced T1-weighted MR image showing a significant reduction of the tumor volume. Three months (4.b) and seven months (4.d) after surgery and Gamma Knife Radiosurgery - coronal T2weighted MR image showing no signs of perifocal edema surrounding the operative cavity.

## DISCUSSION

The most common neurologic manifestation of systemic cancer is brain metastases. Based on patient's clinical presentation and past history data, differential diagnosis can be narrowed. However, the radiologic differential diagnosis of metastasis is difficult since imaging findings are similar to those of high-grade gliomas (HGG). Because of a bloodbrain barrier disruption, both are seen on perfusion MRI as ring-enhancing lesions with surrounding edema. Some authors suggest using peritumoral rCBV for distinguishing metastases from glioblastoma, but the accuracy of this method remains controversial. Magnetic resonance spectroscopy (MRS) has great potential, yet its clinical utility is limited. Diagnostic accuracy may be improved by using combination of advanced imaging protocols, including diffusion, perfusion, and MRS of peritumoral regions. Apart from that, many physiologic and imaging biomarkers and their abilities to define cellularity, angiogenesis, perfusion, pH, hypoxia, may have a prognostic value and further advance diagnosis and treatment. For now, definite diagnosis is made based on pathohistological analysis, but MRI remains the modality of choice for monitoring the response to treatment

(1). A minimally invasive procedure of stereotactic biopsy with evacuation of the cystic content and obtaining a pathohistological sample can be offered to patients not suitable for the procedure under general anesthesia. However, considering that after the evacuation of the cyst the planned target point for sampling changes, stereotactic biopsy carries a high risk of obtaining an inconclusive pathohistological finding. Since the tumor was operable, the biopsy was not performed in our case. With the aim of reduction of disabling neurological symptoms, tumor mass effect, as well as preventing the dissemination of tumor cells with a stereotactic needle, the mainstay of treatment for our patient was resection followed by Gamma Knife Radiosurgery. Whole-brain radiotherapy has a great impact on cognitive function and results in poorer overall quality of life, while Gamma Knife Radiosurgery enables the application of high focal doses of radiation to a volume with low toxicity to adjacent brain structures (2) and has proven to be a great method of treating residual tumor mass.

#### CONCLUSION

Patients with hypopharyngeal squamous cell carcinoma and brain metastasis can attain complete intracranial remission after surgical treatment followed by Gamma Knife Radiosurgery.

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